

Patent claims

1. A filled and polymerizable dental material,  
5 characterized in that it contains:
- a) an organic binder,
- b) a nanoscale filler which has the following  
10 features:
- at least 50% by weight, preferably at least  
60% by weight and particularly preferably at  
least 80% by weight of the nanoparticles have  
15 a particle diameter of less than 200 nm,  
preferably less than 150 nm, particularly  
preferably less than 100 nm,
  - at least 20 particle number%, preferably at  
least 30 particle number%, preferably at  
20 least 40 particle number% and particularly  
preferably at least 50 particle number%, of  
the nanoparticles are aggregated particles,
- c) at least one inorganic and/or organic filler  
25 selected from the group consisting of a  
ground filler having a mean particle size  
between 0.2  $\mu\text{m}$  and 50  $\mu\text{m}$  and a spherical  
filler having a mean particle size between  
0.1  $\mu\text{m}$  and 50  $\mu\text{m}$ .
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2. The dental material as claimed in claim 1,  
characterized in that it contains 1 to 99% by  
weight, preferably 5 to 90% by weight and  
particularly preferably 10 to 80% by weight, of  
35 organic binder a).
3. The dental material as claimed in claim 1 or 2,  
characterized in that it contains 0.1 to 90% by

weight, preferably 1 to 80% by weight and particularly preferably 10 to 60% by weight, of nanoscale filler b).

- 5    4.    The dental material as claimed in one of claims 1  
to 3, characterized in that it contains 0.1 to 95%  
by weight, preferably 1 to 90% by weight and  
particularly preferably 10 to 80% by weight, of  
inorganic and/or organic filler c).
- 10    5.    The dental material as claimed in one of claims 1  
to 4, characterized in that the nanoscale filler  
is organically surface-modified.
- 15    6.    The dental material as claimed in one of claims 1  
to 5, characterized in that it additionally  
contains pyrogenic and/or wet-precipitated silicic  
acids for adjustment of the viscosity.
- 20    7.    The dental material as claimed in claim 6,  
characterized in that it contains 0 to 30% by  
weight, preferably 0 to 20% by weight and  
particularly preferably 0 to 10% by weight, of the  
pyrogenic and/or wet-precipitated silicic acids  
25    for adjustment of the viscosity.
- 30    8.    The dental material as claimed in one of claims 1  
to 7, characterized in that the organic binder a)  
is a compound or a mixture of a number of  
compounds which contains free-radical  
polymerizable and/or cationically and/or  
anionically polymerizable groups and/or groups  
which allow curing by means of a condensation,  
addition and/or acid-base reaction.
- 35    9.    The dental material as claimed in one of claims 1  
to 8, characterized in that the nanoscale filler

b) is a metal, semimetal or mixed metal oxide, silicate, nitride, sulfate, titanate, zirconate, stannate, tungstate or a mixture of these compounds.

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10. The dental material as claimed in claim 9, characterized in that the nanoscale filler b) is silicon dioxide.

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11. The dental material as claimed in one of claims 1 to 10, characterized in that the filler c) is a spherical filler, quartz powder, glass powder, glass ceramic powder or a mixture of these powders.

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12. The dental material as claimed in one of claims 1 to 10, characterized in that the inorganic and/or organic filler c) is a filled or unfilled chip polymer and/or bead polymer.

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13. The dental material as claimed in one of claims 1 to 12, characterized in that the inorganic and/or organic filler c) is surface-modified and has functional groups on its surface which can react chemically with the organic binder a) or have a high affinity for the organic binder a).

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14. The dental material as claimed in one of claims 1 to 13, characterized in that it additionally contains an initiator or a number of initiators and optionally a coinitiator or a number of coinitiators.

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15. The dental material as claimed in one of claims 1 to 14, characterized in that it is X-ray opaque.

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16. The use of the dental material as claimed in one of claims 1 to 15 as a material for prosthetic, preservative and preventive dentistry such as, for example, as a tooth filling material, stump  
5 buildup material, material for temporary crowns and bridges, dental cement, adhesive, material for artificial teeth, veneer material, sealing material and dental lacquer.
- 10 17. A process for the production of dental materials, having the steps:
- a) making available of:
- 15 a1) an organic binder,
- a2) an at least partially agglomerated and/or aggregated nanoscale filler,
- 20 a3) an agent for the organic surface modification of the filler a2),
- a4) at least one inorganic and/or organic filler selected from the group  
25 consisting of a ground filler having a mean particle size between 0.2  $\mu\text{m}$  and 50  $\mu\text{m}$  and a spherical filler having a mean particle size between 0.1  $\mu\text{m}$  and 50  $\mu\text{m}$ ;
- 30 b) carrying out an organic surface modification of the filler a2) using the agent a3);
- c) incorporation of the surface-modified nanoscale  
35 filler into the organic binder until at least 50% by weight, preferably at least 60% by weight, further preferably at least 80% by

weight, of the nanoscale filler has a particle diameter of less than 200 nm, preferably less than 150 nm, particularly preferably less than 100 nm;

- 5 d) incorporation of the filler a4) into the organic binder;

where the steps c) and d) can be carried out in any desired sequence or simultaneously and where  
10 step b) is carried out before or simultaneously to the steps c) and/or d).

18. The process as claimed in claim 17, characterized in that the organic surface modification of the  
15 nanoscale fillers a2) is carried out directly in the organic binder.

19. The process as claimed in claim 17 or 18, characterized in that in step b) additional  
20 mechanical energy is introduced, preferably by means of a high-speed stirrer, a dissolver, a bead mill or a mixer.

20. The process as claimed in one of claims 17 to 19, characterized in that the organic binder a1) is a  
25 compound or a mixture of a number of compounds which contains free radical-polymerizable and/or cationically and/or anionically polymerizable groups and/or groups which allow curing by means  
30 of a condensation, addition and/or acid-base reaction.

21. The process as claimed in one of claims 17 to 20, characterized in that the nanoscale filler a2) is  
35 a metal, semimetal or mixed metal oxide, silicate, nitride, sulfate, titanate, zirconate, stannate, tungstate or a mixture of these compounds.

22. The process as claimed in claim 21, characterized in that the nanoscale filler a2) is silicon dioxide.
- 5 23. The process as claimed in one of claims 17 to 22, characterized in that in the organic surface modification groups are introduced onto the surface of the nanoscale fillers a2) which can react chemically with the organic binder a1) or  
10 have a high affinity for the organic binder.
24. The process as claimed in one of claims 17 to 23, characterized in that the agent employed for the organic surface modification is a silane,  
15 chlorosilane, silazane, titanate, zirconate and/or tungstate.
25. The process as claimed in one of claims 17 to 24, characterized in that the inorganic and/or organic  
20 filler a4) is a spherical filler, quartz powder, glass powder, glass ceramic powder or a mixture of these powders.
26. The process as claimed in one of claims 17 to 24, characterized in that the inorganic and/or organic  
25 filler a4) is a filled or unfilled chip polymer and/or bead polymer.
27. The process as claimed in one of claims 17 to 26,  
30 characterized in that the inorganic and/or organic filler a4) is organically surface-modified and thus has functional groups on its surface which can react chemically with the organic binder a1) or have a high affinity for the organic binder.